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The genus *Hygrocrates* Deeleman-Reinhold, 1988 (Araneae, Dysderidae) in Turkey

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Abstract

A new species, *Hygrocrates deelemanus* Kunt & Yağmur **sp. n.**, is described on the basis of both sexes from the Mediterranean region of Turkey. Detailed morphological descriptions, diagnosis and figures of the copulatory organs of both Turkish species are presented. An identification key is presented for all the currently known species of *Hygrocrates*.

Keywords

Dysderidae, *Hygrocrates*, new species, systematic key, Turkey

Introduction

Hygrocrates Deeleman-Reinhold, 1988 is a small dysderid genus which contains only three previously described species: *Hygrocrates caucasicus* Dunin, 1992; *H. georgicus* (Mcheidze, 1972) and *H. lycaoniae* (Brignoli, 1978). *H. caucasicus* and *H. georgicus* are

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endemic to Georgia, while *H. lycaoniae* is known from Rhodes and Turkey. *Hygrocrates lycaoniae* was originally ascribed to *Harpactocrates* Simon, 1914. In their revision of Dysderinae spiders of the Mediterranean region, Deeleman-Reinhold and Deeleman (1988) transferred *H. lycaoniae* to the new genus *Hygrocrates*, which was differentiated from *Harpactocrates* as follows: posterior median eyes closer to each other; anterior cheliceral teeth smaller in the basal region, and the presence of a subapical apophysis on the male palp. *H. georgicus,* originally ascribed to *Harpactocrates,* was only provisionally transferred to the genus *Hygrocrates* by Deeleman-Reinhold and Deeleman (1988); see also Dunin (1992) who reported that the female holotype of this species was lost. Subsequently, the third, new species *H. caucasicus* was described by Dunin (1992), based on two male specimens from the Georgia.

To date, only *H. lycaoniae* has been recorded from Turkey based on only one male in a sample collected from outside Körükini Cave (Konya province, Beyşehir District, Çamlık town). After the original description by Brignoli (1978), Deeleman-Reinhold and Deeleman (1988) redescribed this species based on male and female specimens collected from Greece. During our surveys of the Turkish spider fauna we collected some specimens of *H. lycaoniae,* in addition to some specimens that were impossible to place in any of the known species of *Hygrocrates*. In this paper, a new species of the genus, namely *Hygrocrates deelemanus* sp. n., is described based on both sexes, collected from the southern region of Turkey. The characteristic features of both species, including photographs of the prosoma and of the copulatory organs, are provided for comparative purposes.

Material and methods

All specimens were collected from two different localities in Turkey (Fig. 1). The specimens were collected by sifting of leaf litter and preserved in 70% ethanol. Digital images of the pedipalp and vulva were taken with a Leica DFC295 digital camera attached to a Leica S8AP0 stereomicroscope and 5–15 photographs were taken in different focal planes and combined. Photographic images were edited using Photoshop CS2 and Corel-DRAW X3 was used to create the plates. All measurements are in mm. Terminology for the body measurements and copulatory organ structures follows Deeleman-Reinhold and Deeleman (1988) and Chatzaki and Arnedo (2006). The following terminology is used for the male palp: apical apophysis of the male palp, **Embolus**; subapical apophysis of the male palp, **Apophysis$_a$**; and posterior apophysis of the male palp, **Apophysis$_b$**.

Material treated herein is deposited in the personal collection of Kadir Boğaç Kunt (**cKBK**, Ankara, Turkey) and in the Senckenberg Museum (**SMF**, Frankfurt am Main, Germany). The following abbreviations are used in the text: **AL**, abdominal length; **CL**, carapace length; **CWmax**, maximum carapace width; **CWmin**, minimum carapace width; **AME**, anterior median eyes; **PLE**, posterior lateral eyes; **PME**, posterior median eyes; **AMEd**, diameter of anterior median eyes; **PLEd**, diameter of posterior

Figure 1. Map showing the localities from which *Hygrocrates* specimens have been recorded. ★ the type locality of *H. deelemanus* sp. n.; ♦ the type locality of *H. lycaoniae*; ● locality of *H. lycaoniae* from Turkey; ■ locality of *H. lycaoniae* from Rhodos island (Greece).

lateral eyes; **PMEd**, diameter of posterior median eyes; **ChF**, length of cheliceral fang; **ChG**, length of cheliceral groove; **ChL**, total length of chelicera (lateral external view); **Ta**, tarsus; **Me**, metatarsus, **Ti**, tibia; **Pa**, patella; **Fe**, femur; **Tr**, trochanter; **C**, coxa; **D**, dorsal; **Pl**, prolateral; **Rl**, retrolateral; **V**, ventral.

Key to the *Hygrocrates* species

1 Male **2**
– Female **4**
2 Bulbus straight, cylindrical; embolus lobe-shaped; apophysis$_a$ and apophysis$_b$ nearly same size..... ***H. caucasicus***
– Bulbus pyriform; embolus hook-shaped; apophysis$_a$ and apophysis$_b$ smaller than embolus **3**
3 Transition between bulbus and distal continuation is gradual (Figs 30–33, 36)..... ***H. lycaoniae***
– Transition between bulbus and distal continuation is abrupt, clearly curved over 90° (Figs 16–19, 35) ..... ***H. deelemanus* sp. n.**
4 Distalmost part of spermathecae linear ..... ***H. georgicus***
– Distalmost part of spermathecae oval..... **5**
5 Proxialmost part of spermathecae oval (Fig. 20) ..... ***H. deelemanus* sp. n.**
– Proxialmost part of spermathecae circular (Fig. 34)..... ***H. lycaoniae***

Taxonomy

Hygrocrates Deeleman-Reinhold, 1988

H. Deeleman-Reinhold, in Deeleman-Reinhold and Deeleman, 1988: 240, type *Harpactocrates lycaoniae* Brignoli, 1978.

Hygrocrates deelemanus Kunt & Yağmur sp. n.

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Figs 2–21, 35, 37

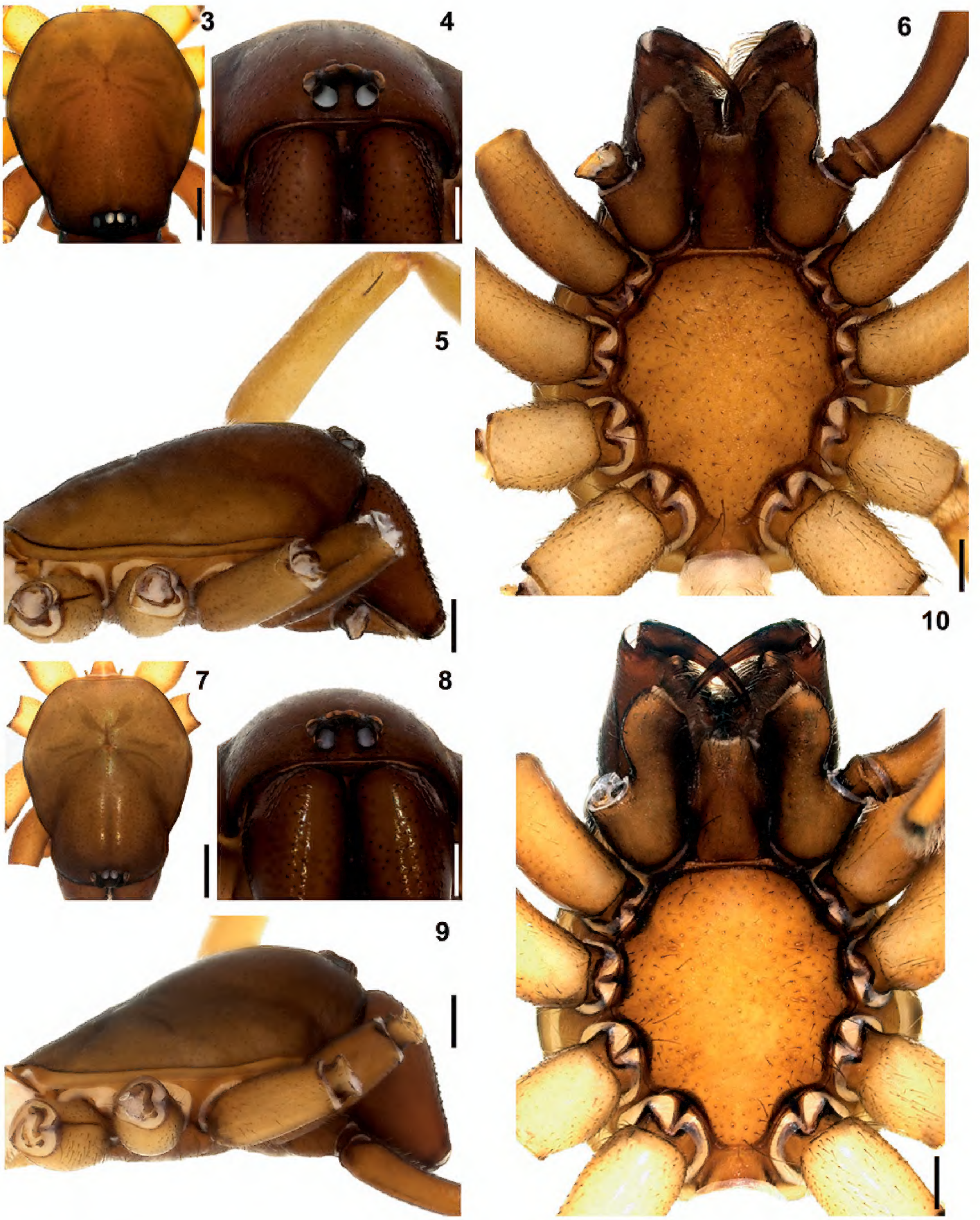
Material Examined: Holotype ♂ (SMF) **Antalya Province**, Alanya District, Taşatan Plateau [36°38'33.20"N; 32°4'44.40"E], 09.I.2010, leg. K.B.Kunt. Paratypes: 1♀ (abdomen heavily damaged during dissection) (SMF), 1♂ (cKBK) same data as holotype.

Diagnosis: The male palp of *Hygrocrates deelemanus* sp. n. is most similar to that of *H. lycaoniae*. Bulbal apophyses are shorter than the embolus in both species. However, the transition between the bulbus and distal continuation is more abrupt in *H. deelemanus* sp. n., clearly curved over 90°, whereas it is more gradual in *H. lycaoniae*. In the vulva, the proximalmost part of the spermathecae is larger and wider than in *H. lycaoniae*.

Figure 2. *Hygrocrates deelemanus* sp. n. (Holotype ♂); scale line: 1 mm.

Derivatio nominis: The specific name is given in honour of Dr. Christa L. Deeleman-Reinhold, a prominent Netherlander arachnologist who described the genus *Hygrocrates*.

Measurements (Holotype ♂ / Paratype ♀): AL 3.84 / ?; CL 2.76 / 3.04; CWmax 2.28 / 2.40; CWmin 1.40 / 1.76; AMEd 0.16 / 0.19; PLEd 0.12 / 0.14; PMEd 0.10



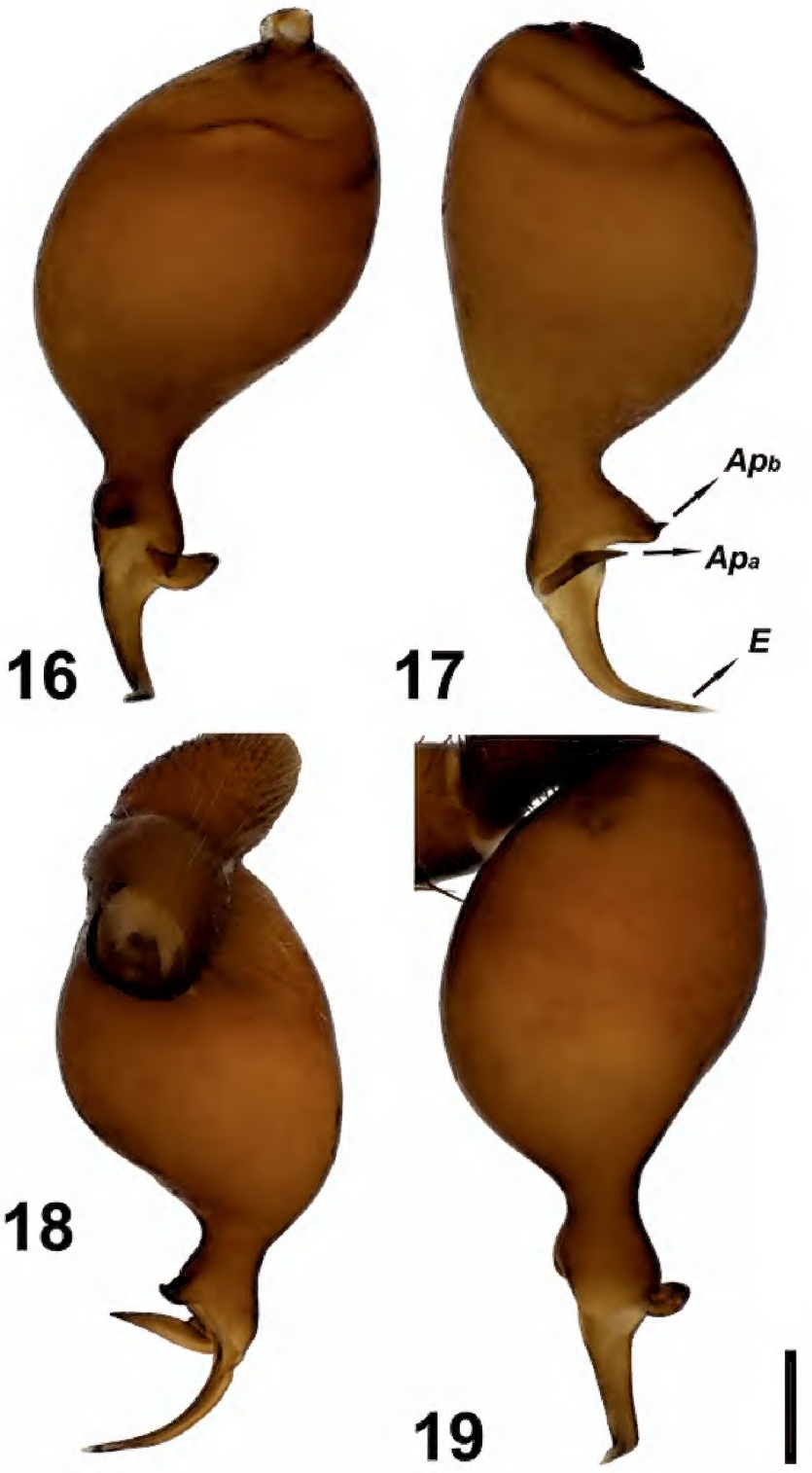
Figures 3–10. *Hygrocrates deelemanus* sp. n. **3** (♂), **7** (♀) carapace, dorsal view **4** (♂), **8** (♀) ditto, anterior view **5** (♂), **9** (♀) ditto, lateral view **6** (♂), **10** (♀) ditto, ventral view. Scale lines: (3, 5, 6, 7, 9, 10) 0.5 mm; (4, 8) 0.25 mm.

Figure 11. Cheliceral teeth of *Hygrocrates deelemanus* sp. n.

Figures 12–15. Tarsal and metatarsal scopulae of *Hygrocrates deelemanus* sp. n. (♂), **12** leg I, **13** leg II, **14** leg III, **15** leg IV. Scale lines: 0.25 mm

/ 0.11; ChF 0.77 / 0.82; ChG 0.46 / 0.52; ChL 1.20 / 1.50. Leg measurements are given in Table 1.

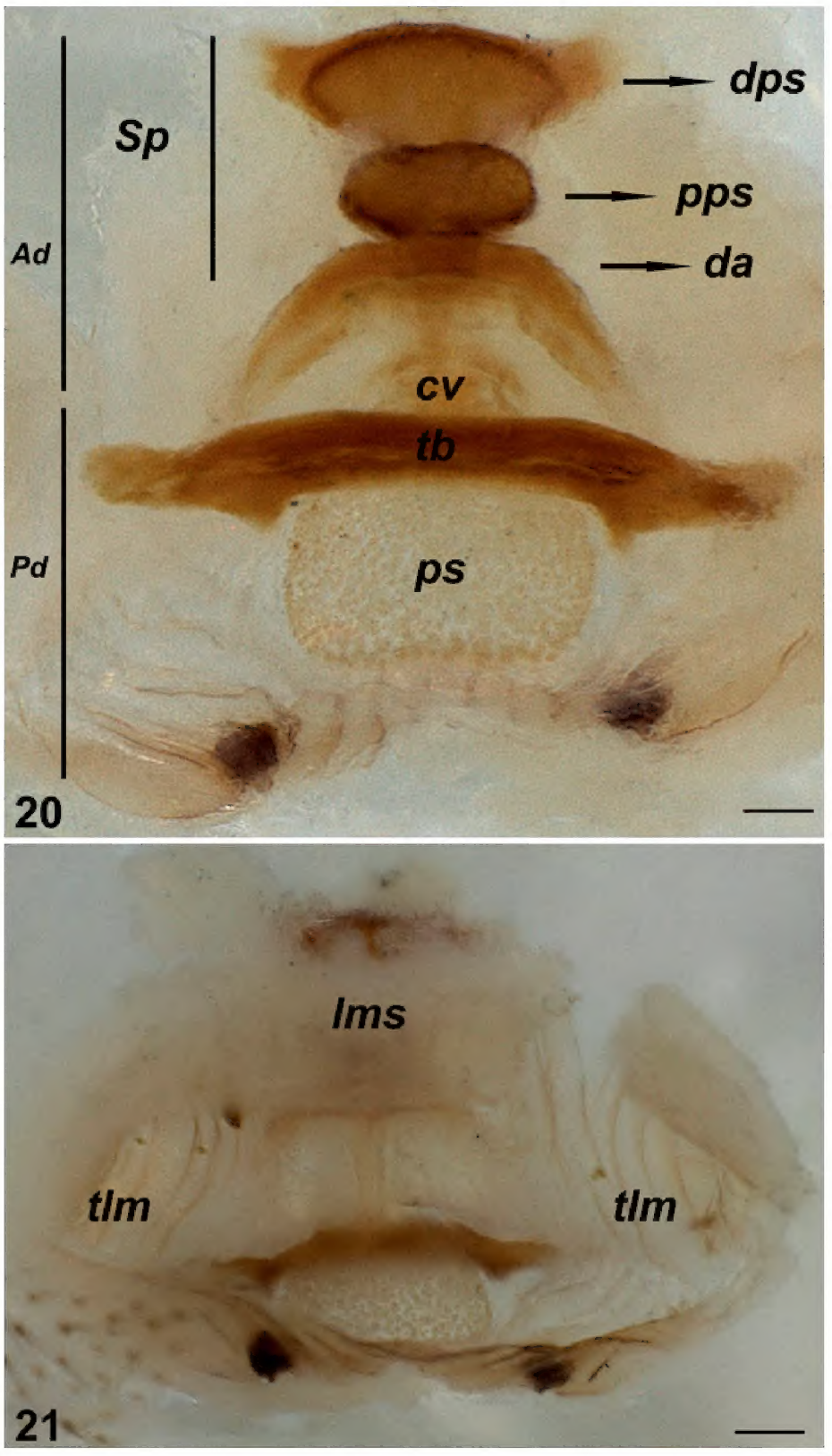
Description: Carapace hexagonal-shaped, reddish brown, surface of carapace with small dark shallow depressions. Cephalic region dark brownish, narrow and clearly higher than thoracic region (Figs 2, 3, 5, 7, 9). Chilum triangular-shaped, distinct, coloured as carapace and chelicerae and broader in females (Figs 4, 8). Fovea short, straight and longitudinal (Figs 2, 3, 7). AME, PLE and PME closely grouped. Distance of AME-PLE shorter than PLE-PME. AME separated (Figs 4, 8). Labium, gnathocoxae and chelicerae brown. Labium and gnathocoxae covered with dark hairs; more densely so on gnathocoxae. Labium wider at the base. Gnathocoxae rounded laterally,



Figures 16–19. Male palp of *Hygrocrates deelemanus* sp. n. Abbreviations: ***Ap***$_a$ apophysis$_a$ ***Ap***$_b$ apophysis$_b$ ***E*** embolus. Scale line: 0.1 mm.

with inwardly notched tips and blackish along the margins. Sternal border of gnathocoxae pentagonal-shaped, cheliceral region arrow-shaped with blunt tip (Figs 6, 10).

Chelicerae brownish with darker tubercules; basally broader in females and laterally swollen (Figs 4, 8). Cheliceral groove with four teeth: retromargin with four teeth, including one small and one large tooth at the base of the groove (Fig. 11). Sternum and abdomen yellowish brown, with thin blackish hairs over the entire surfaces. Legs yellowish brown. Palps and legs I and II darker than legs III and IV. Leg length formula: Leg I > Leg IV > Leg II > Leg III. Tarsi with two claws and claw tufts. All tarsi with fine tarsal scopulae. Legs III and IV with metatarsal scopulae (Figs 12–15). Coxae without spines. Details of leg spination are given in Table 2.



Figures 20–21. Vulva of *Hygrocrates deelemanus* sp. n. **20** dorsal view **21** ventral view. Abbreviations: ***Ad*** anterior diverticulum ***Pd*** posterior diverticulum ***Sp*** spermatheca ***dps*** distalmost part of spermatheca ***pps*** proximalmost part of spermatheca ***da*** dorsal arch ***cv*** central valve ***tb*** transverse bar ***ps*** membranous sac ***lms*** large membranous sac ***tlm*** twisted lateral membranes. Scale lines: 0.1 mm.

Table 1. Leg measurements of *Hygrocrates deelemanus* sp. n.

(Holotype ♂ / Paratype ♀)	Fe	Pa	Ti	Me	Ta
Leg I	2.32 / 2.52	1.60 / 1.66	2.00 / 2.43	2.24 / 2.30	0.64 / 0.63
Leg II	2.08 / 2.32	1.48 / 1.44	1.80 / 1.84	2.08 / 1.96	0.56 / 0.60
Leg III	1.76 / 1.92	0.88 / 1.12	1.20 / 1.40	1.60 / 1.88	0.56 / 0.60
Leg IV	2.40 / 2.48	1.36 / 1.36	1.88 / 2.08	2.20 / 2.60	0.59 / 0.61

Table 2. Leg spination of *Hygrocrates deelemanus* sp. n.

♂ (Holotype)	Leg I	Leg II	Leg III	Leg IV
C	0	0	0	0
Tr	0	0	0	0
Fe	Pl 1	Pl 0–1	D 1	D 1, 1
Pa	0	0	0	0
Ti	0	0	Pl 1 Rl 1, 2 V 1, 2	Pl 2, 2 Rl 2, 1 V 1, 1
Me	0	0	Pl 1, 1 D 2, 2 Rl 1, 2, 1, 1 V 2, 2	Pl 5 Rl 5 V 2
Ta	0	0	0	0
♀ (Paratype)				
C	0	0	0	0
Tr	0	0	0	0
Fe	Pl 2	Pl 1	0	D 1, 1
Pa	0	0	0	0
Ti	0	0	Pl 1 Rl 1, 2 V 1, 2	Pl 2, 2 Rl 1, 1 V 1, 2
Me	0	0	Pl 1, 1 Rl 1, 1, 1, 1 V 1, 2	Pl 5 Rl 5 V2
Ta	0	0	0	0

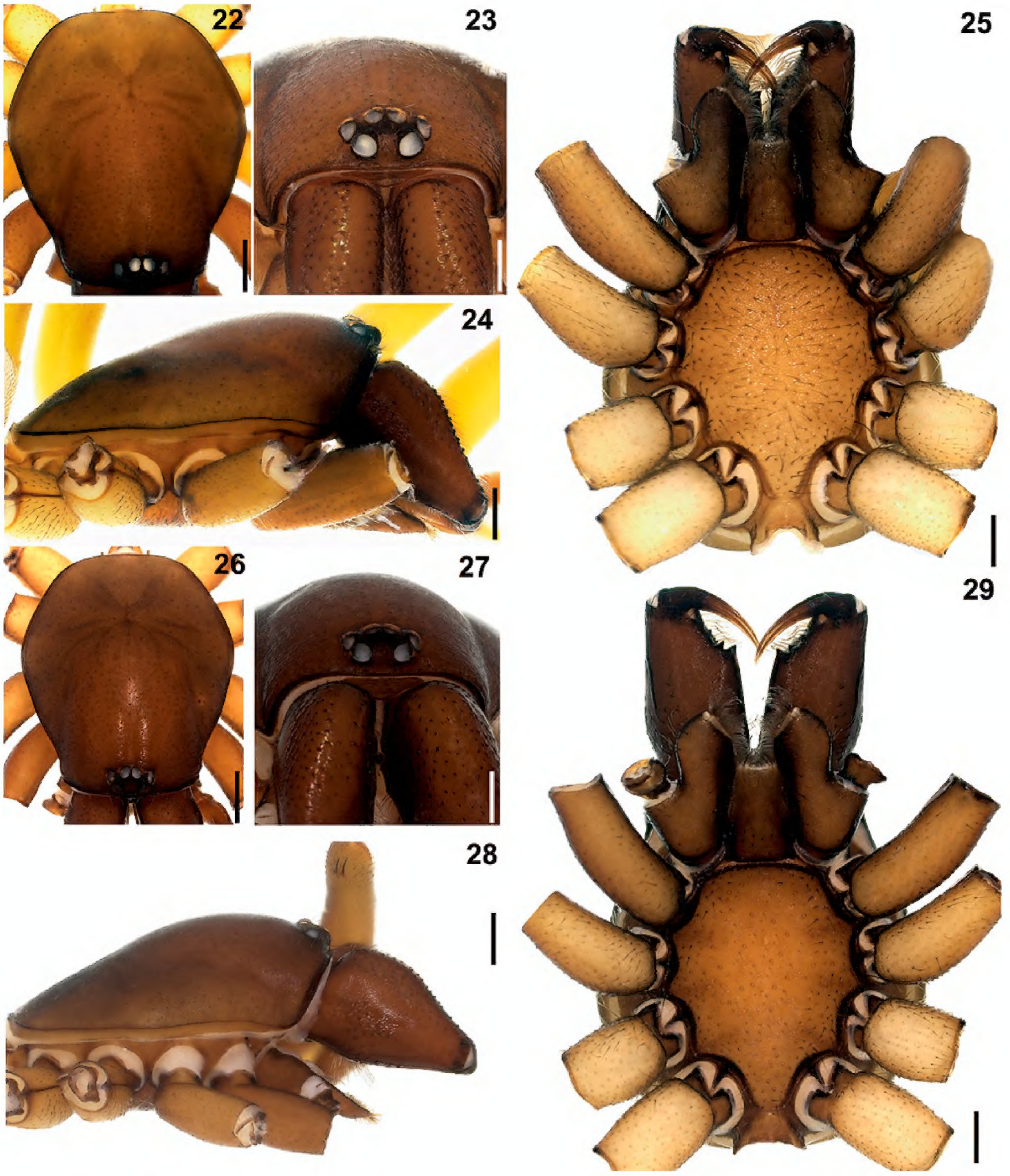
Palpal organ with pyriform bulbus and hook-shaped (tapering towards the tip) embolus. Bulbal apophyses are more strongly sclerotized than the embolus (Figs 16–19). Vulva with two parts: anterior diverticulum and posterior diverticulum (Fig. 20). Anterior diverticulum consists of a dorsal arch with spermathecae which have two parts (distalmost and proximalmost parts), a large membranous sac (clearly visible in dorsal view) and widened twisted lateral membranes (Fig. 21). Posterior diverticulum consists of a central valve with a transverse bar, a wide membranous sac and a couple of small lateral membranous pockets (Fig. 20).

***Hygrocrates lycaoniae* (Brignoli, 1978)**
Figs 22–34, 36, 38

Harpactocrates l.: Brignoli, 1978: 463, f. 2, 8 (D ♂).
H. l.: Deeleman-Reinhold & Deeleman, 1988: 240, f. 13, 22, 320–325 (T ♂ from *Harpactocrates*, D ♀).
H. l.: Dunin, 1992: 41, f. 3 (♂ ♀).

Material Examined: 1 ♂, 1 ♀ (SMF) (abdomen heavily damaged during dissection) **Burdur Province**, Yeşilova District, side of Salda Lake [37°30'32.78"N; 29°41'56.66"E], 14.VII.2010, leg. E.A.Yağmur & M. Elverici.

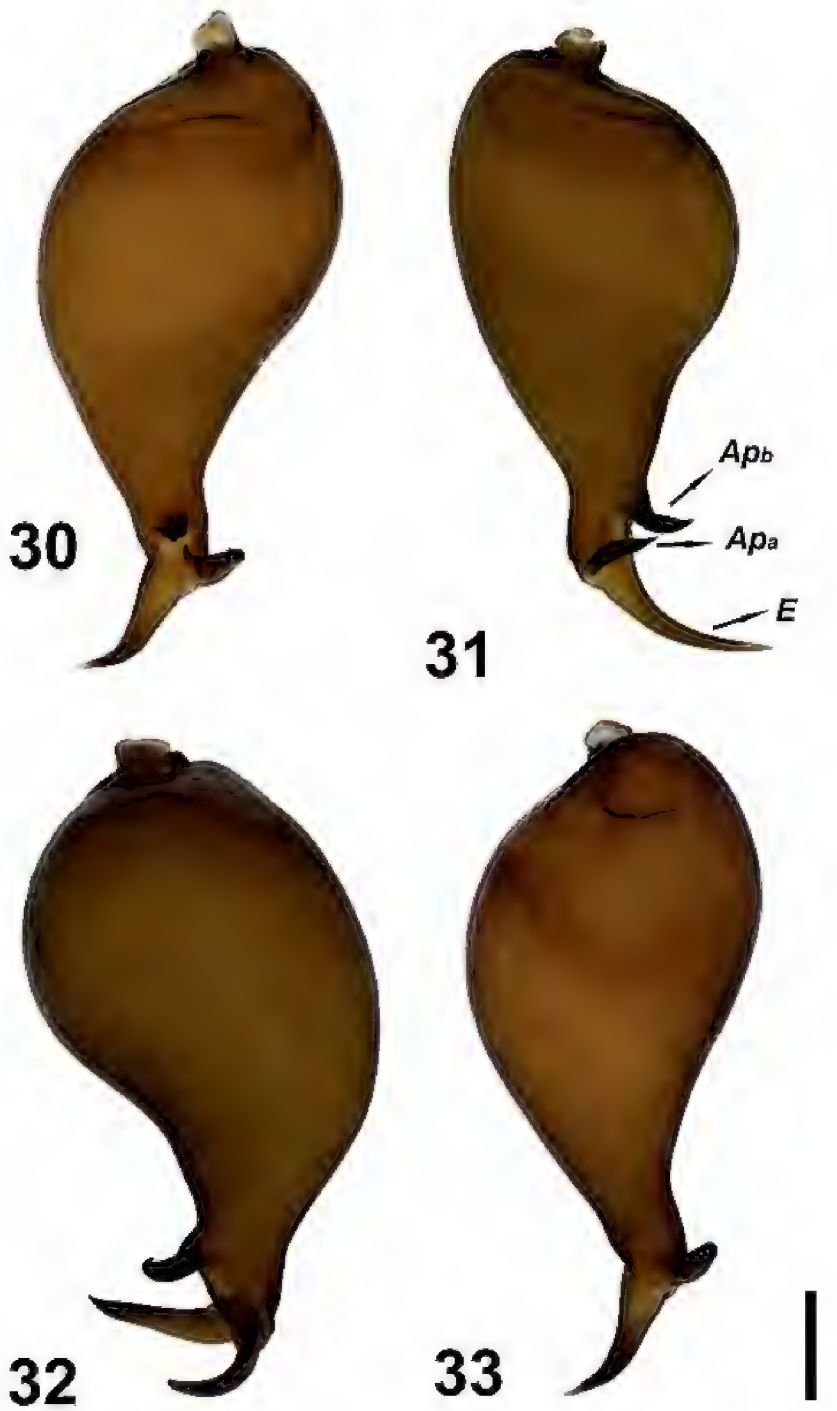
Diagnosis: *H. lycaoniae* can be distinguished from *H. caucasicus* by the pyriform shape of the bulbus (bulbus smooth and cylindrical in *H. caucasicus*) (see Dunin



Figures 22–29. *Hygrocrates lycaoniae* **22** (♂), **26** (♀) carapace, dorsal view **23** (♂), **27** (♀) ditto, anterior view **24** (♂), **28** (♀) ditto, lateral view **25** (♂), **29** (♀) ditto, ventral view. Scale lines: (22, 24, 25, 26, 28, 29) 0.5 mm; (23, 27) 0.25 mm

1992); and from *H. georgicus* by having apically oval-shaped spermathecae (see Mcheidze 1972).

Note: *H. caucasicus* was originally described on the basis of two males by Dunin (1992). The females of this species have not been collected yet, but the bulbal structures of the male palp were well illustrated by Dunin (1992). However, the information of *H. georgicus* is still insufficient. The following information was given by Dunin (1992:



Figures 30–33. Male palp of *Hygrocrates lycaoniae.* Abbreviations: ***Ap***$_a$ apophysis$_a$ ***Ap***$_b$ apophysis$_b$ ***E*** embolus. Scale line: 0.1 mm.

p. 60) in his review of the Caucasian Dysderidae (our translation!): *"H. georgicus was described on the basis of the female holotype from Georgia: the vicinity of Tbilisi, Kodzhori, Udzho. The holotype was lost. The species was tentatively placed in Hygrocates by Deeleman-Reinhold and Deeleman (1988). To confirm their placement addition material is required. This species is absent from my collection."* During the preparation of this paper, as a result of our correspondence with the Tbilisi Janashia Museum (Georgia) which retains the spider collection of Tamara Mcheidze, it is obvious that the holotype of this species is lost (S. Otto pers. comm.). Thus, we could not examine it, but on the basis of the original illustrations of the vulva by Mcheidze (1972), *H. georgicus* can be distinguished from the Turkish members of the genus by the linear distalmost part of spermathecae.

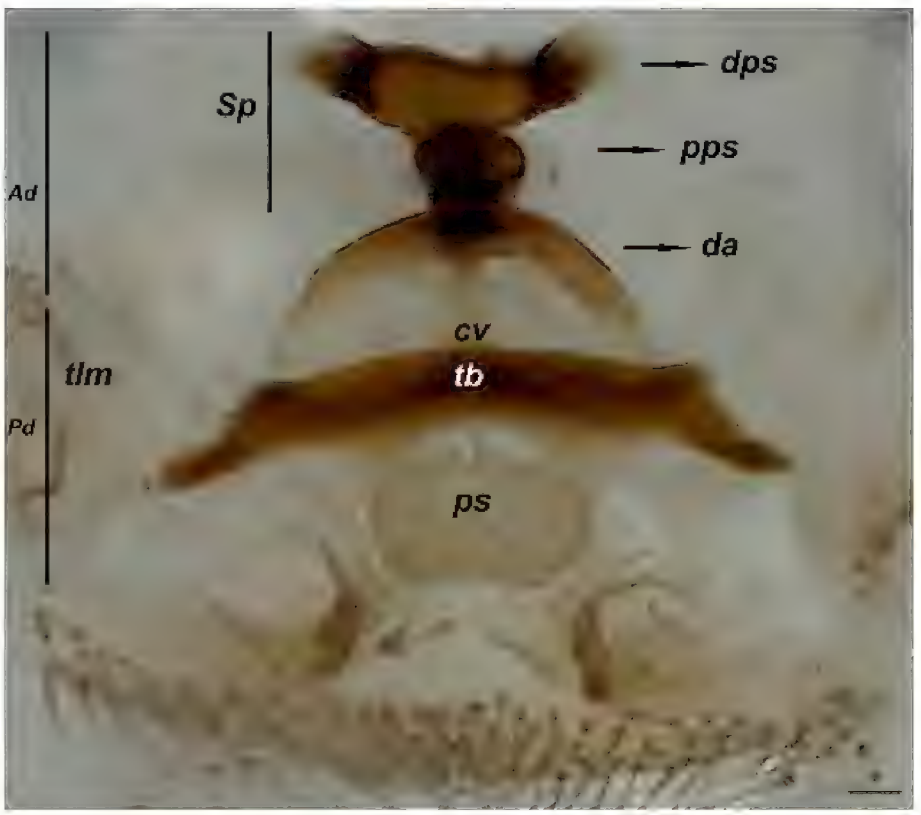


Figure 34. Vulva of *Hygrocrates lycaoniae*, dorsal view. Abbreviations: ***Ad*** anterior diverticulum ***Pd*** posterior diverticulum ***Sp*** spermatheca ***dps*** distalmost part of spermatheca ***pps*** proximalmost part of spermatheca ***da*** dorsal arch ***cv*** central valve ***tb*** transverse bar ***ps*** membranous sac ***tlm*** twisted lateral membranes. Scale line: 0.1 mm

Measurements (♂ / ♀): AL 3.36 / ?; CL 2.40 / 3.00; CWmax 2.20 / 2.44; CWmin 1.52 / 1.76; AMEd 0.14 / 0.16; PLEd 0.13 / 0.15; PMEd 0.11 / 0.12; ChF 0.77 / 0.79; ChG 0.45 / 0.50; ChL 1.30 / 1.46. Leg measurements are given in Table 3.

Description: General features of the body of *H. lycaoniae* closely resemble the new species (Figs 22–29), *H. deelemanus* sp. n., but the two are easily differentiated by their different body sizes and by structures of the male and female genitalia (Figs 30–33, 35–38). The males of the two species are easily distinguished in ventral view (90° angle) by the terminal part of the bulbus having the following characteristics:

1. Embolic base is pear-shaped in the two species, but the tip of the embolic base located at 12 o'clock in *H. deelemanus* sp. n. (Fig. 37) and at 10 o'clock in *H. lycaoniae* (Fig. 38).
2. Apophysis$_a$ and Apophysis$_b$ are short and blunt in *H. deelemanus* sp. n. (Fig. 37), but long in *H. lycaoniae* (Fig. 38).

Table 3. Leg measurements of *Hygrocrates lycaoniae*

(♂ / ♀)	Fe	Pa	Ti	Mt	Ta
Leg I	2.28 / 2.24	1.40 / 1.44	1.84 / 1.96	2.36 / 1.92	0.53 / 0.60
Leg II	2.08 / 2.00	1.44 / 1.40	1.85 / 1.72	1.92 / 1.80	0.50 / 0.56
Leg III	1.73 / 1.68	1.10 / 0.92	1.29 / 1.16	1.58 / 1.52	0.50 / 0.48
Leg IV	2.19 / 2.20	1.20 / 1.20	1.83 / 1.76	2.20 / 2.12	0.60 / 0.56

Figures 35–38. Comparison of the palps of the two species. **35, 37** *H. deelemanus* sp. n. **36, 38** *H. lycaoniae*. Abbreviations: ***Ap***$_a$ apophysis$_a$ ***Ap***$_b$ apophysis$_b$ ***E*** embolus.

3. Apophysis$_b$ originates near the tip of the embolic base in *H. deelemanus* sp. n. (Fig. 37), but originates from the central part of the tip of the embolic base in *H. lycaoniae* (Fig. 38).
4. Embolus is curved between Apophysis$_a$ and Apophysis$_b$ in *H. deelemanus* **sp. n.** (Fig. 37), but is raised from the embolic base and separated from Apophysis$_a$ and Apophysis$_b$ in *H. lycaoniae* (Fig. 38).

The females of the two species are easily distinguished by the form of the proximalmost part of the spermathecae which is oval in *H. deelemanus* sp. n. (Figs 20–21) and circular in *H. lycaoniae* (Fig. 34). Details of leg spination are given in Table 4.

Habitat and distribution

The holotype of *H. lycaoniae* was collected from outside of Körükini Cave, which is located in Çamlık Village (Beyşehir District, Konya Province). The vegetation surrounding the cave is the mixed forest composed of Taurus fir, juniper, oak and maple species. Annual and perennial herbaceous plants also grow very densely around the cave (Fig. 39). Although several field trips were conducted to the type locality, we failed

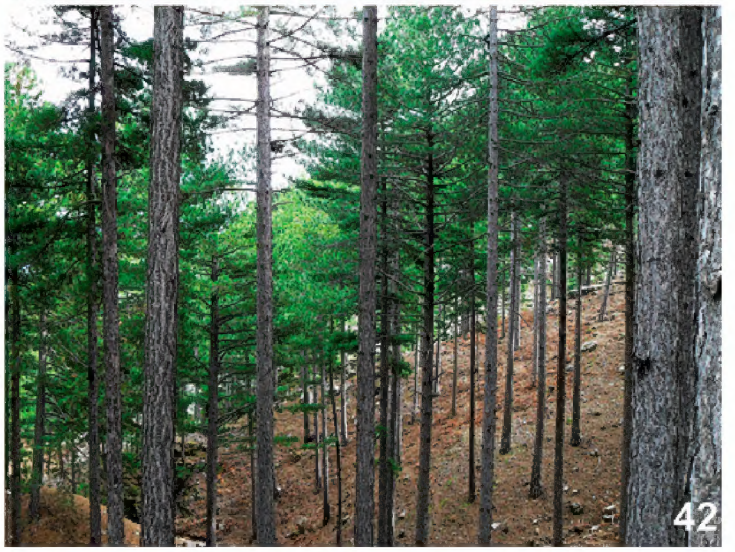
Table 4. Leg spination of *Hygrocrates lycaoniae*

	Leg I	Leg II	Leg III	Leg IV
♂				
C	0	0	0	0
Tr	0	0	0	0
Fe	Pl 2	Pl 1	D 1	D 2
Pa	0	0	0	0
Ti	0	0	Pl 1 Rl 1, 2 V 1, 2	Pl 2, 2 Rl 1, 1, 1 V 1, 2
Me	0	0	Pl 1, 1, 1 Rl 1, 1, 1 V 2, 2	Pl 1, 1, 1, 1 Rl 5 V 2
Ta	0	0	0	0
♀				
C	0	0	0	0
Tr	0	0	0	0
Fe	Pl 1–2	Pl 1	0	D 2
Pa	0	0	0	0
Ti	0	0	Pl 1 Rl 1, 2 V 1, 2	Pl 2, 2 Rl 2, 1 V 1, 2
Me	0	0	Pl 1 Rl 1, 1, 1 V 2, 2	Pl 1, 1, 1 Rl 1, 1, 1, 1 V 2, 2
Ta	0	0	0	0

to find any specimens of *H. lycaoniae*. However, our male and female specimens of *H. lycaoniae* were collected near to Salda Lake (Burdur Province), which is approximately 170 km apart from the type locality (Figs 40, 41). The specimens were collected in the leaf-litter of shrublands surrounding the Salda Lake. Deeleman-Reinhold and Deeleman (1988) collected their samples of *H. lycaoniae* from leaf litter and under stones of wetland areas in Rhodes island. Therefore, it is safe to conclude that *H. lycaoniae* prefers wetland habitats. We collected the samples of the new species, *H. deelemanus* **sp. n.**, from leaf litter under *Pinus nigra* trees (Fig. 42). Therefore it can be concluded that the two species are distributed in different habitat types of the Mediterranean.

Discussion

In general, the taxonomy of the subfamily Dysderinae is well defined (see Deeleman-Reinhold and Deeleman 1988; Dunin 1992). To date, 24 Dysderinae species, including the newly described species, have been recorded from Turkey in the following four genera: *Dysdera* Latreille, 1804 (20 species), *Dysderocrates* Deeleman-Reinhold & Deeleman, 1988 (1 species), *Harpactocrates* (1 species) and *Hygrocrates* (2 species) (Bayram et al. 2010; present data). The diversity of Dysderinae is not very high compared to neighbouring Greece (36 species: 34 *Dysdera* species, 2 *Dysderocrates* species) and Georgia (28 species: 3 *Cryptoparachtes* species, 21 *Dysdera* species, 1 *Harpactocrates* species and 2 *Hygrocrates* species). Nevertheless, the Turkish Dysderinae fauna includes more species than the other neighbouring countries, such as Azerbaijan (17 species), Bulgaria (14 species) and Armenia (4 species) (Otto and Dietzold 2006; Helsdingen 2010).



Figures 39–42. Habitats of *Hygrocrates* species. **39** The type locality of *H. lycaoniae* in Konya province **40, 41** Localities of *H. lycaoniae* in Burdur province **42** The type locality of *H. deelemanus* sp. n.

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